Successful Adoption and Use of Object Oriented Technologies

STC ‘97

April 30, 1997

Jim Van Buren

#*

Objective

- Presentation of Model for Adoption of OT by DoD Organizations
  - For Non-OO capable DoD organizations
  - Training Issues
  - Development Process Issues
  - OO Management Issues

#*

Outline

- Background
  - Object Oriented Definitions
  - Technology Adoption
- OO Technology Adoption
  - DoD Adoption Context
  - Training
  - Development Process
  - Management
  - Pushing Adoption

Why OO?

- **Maintainability Advantages**
- Time to Market
- Required by COTS Libraries
- Reuse
- …

Why Not OO?

- **Organizational Change**
- Existing System Meets Requirements
- …
- Resource Cost (Memory and Processing Time)

#*

Encapsulation

Underlying Concept behind OO

- An object's interface is the only way the object can be manipulated or used
- Clients know only about an object's interface
- Encapsulates Data and Methods
  - Allows Objects and their clients can be written in different languages
  - Allows Objects and their clients can run on different machines
  - Isolates inevitable maintenance changes
  - Enables Geographically Distributed Development by loosely coupled teams
  - Enables Evolutionary Development
  - Enables Reuse

#*

What is OO Development?

- Conceptualize and Abstract Requirements
- Analysis (Develop Models)
- Design (Create Architectures)
- Evolve Application (Iteratively)

Macro

Micro

- Identify Classes
- Identify Objects
- Identify Relationships
- Specify Interfaces
- Write Code
- Fix Application (Iteratively)

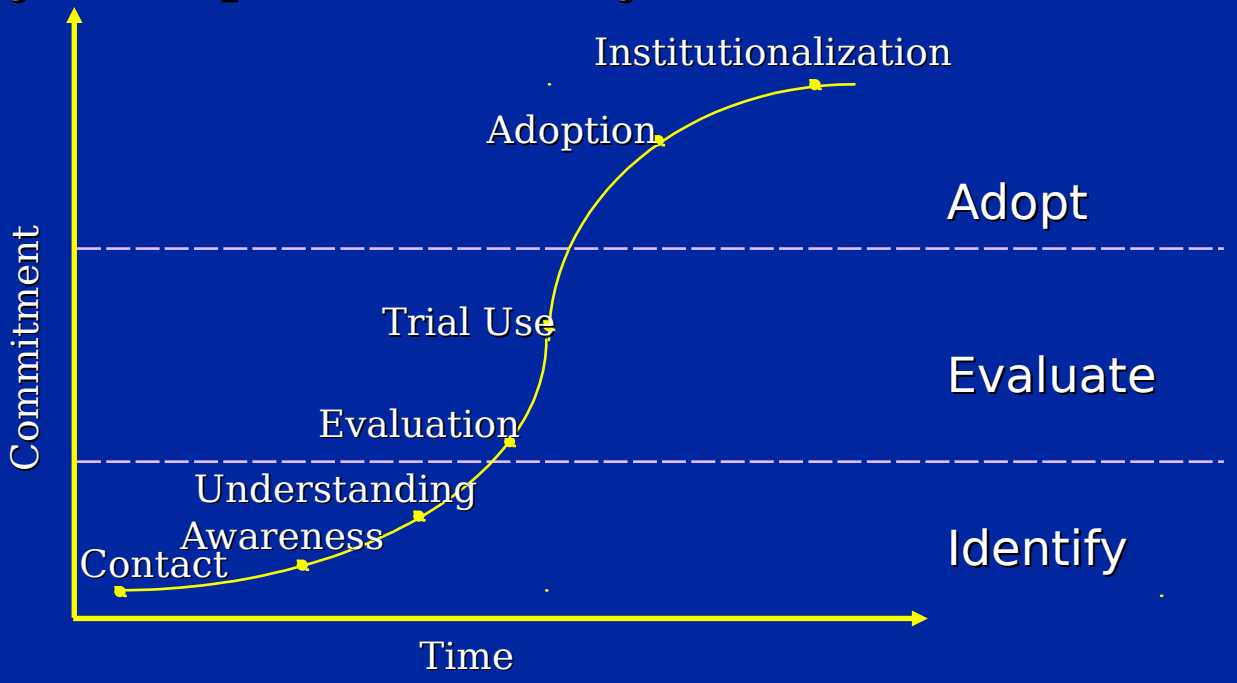
Both are Valid Views!

Both are Necessary!

#*

Technology Adoption

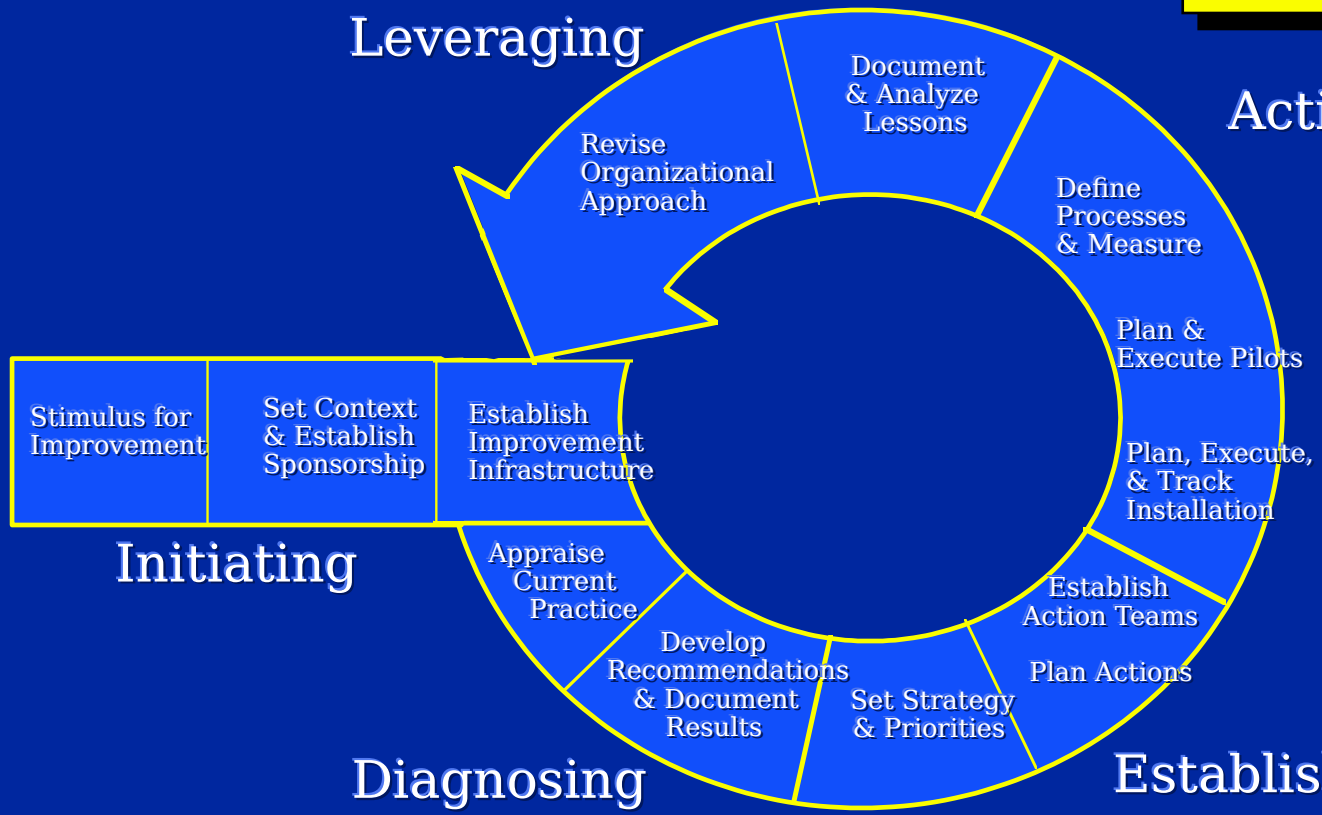
- The STSC helps U.S. Air Force organizations identify, evaluate, and adopt technologies that improve software product quality, production efficiency, and predictability.”



Adapted From: Fowler & Przybylinski, 1988

Technology Adoption

Based on SEI's IDEAL Model



Pilot OT

Tailor and use "standard" STSC OT adoption plan.

OT is increasingly a potential solution

Outline

- Background
  - Object Oriented Definitions
  - Technology Adoption
- OO Technology Adoption
  - DoD Adoption Context
  - Training
  - Development Process
  - Management
  - Pushing Adoption

DoD Adoption Context

Project Attributes

- Functionality — Errors not Tolerated
- Schedule — Predictable
- Maintainable — Very long software lifetime
- Community expects Reviews and Documents
- Move underway from Mainframe to Workstation or PC platforms

#*

DoD Adoption Context (cont.)

Organizational Attributes

- Personnel
  - Civilians — Very Low Turnover
  - Military — Very High Turnover
  - Contractors — Critical to success
- Hierarchical and Command Driven Organizations
- Very Strong Mission Focus
- SPI Activities underway
- Training Funds controlled by Organization (not Project)

#*

OT Adoption Issues

General Adoption Issues

- Resistance to Change
- On Going Improvement Programs
- Mission Requirement

OO & OT Specific

- Training
- Development Process
- Management Changes

#*

Training

- Focus on Paradigm Shift
  - Education not Training
  - Very Long Time Scale
- Must Map to Development Process
  - Training not Education
- Training Truisms Apply
  - Just in Time
  - Mentoring
- Build Organic Training Capability
  - High Turnover
  - Long Product LifeCycle
- Provide Training to Project Reviewers

#*

Development Process

- Incremental
  - Largest Process Change
  - A few Formal Reviews replaced by many “In Process” Reviews
  - Monolithic Specification (requirements or design) replaced by evolving baseline(s)
- Different from the Old Process
  - Let the technical gurus specify it
  - Make sure it specifies sound software engineering processes
    - Formal Design and Test subprocesses
    - Metrics Collection
    - A Formal Peer Review Process
    - Coding Standards
- Focus on the Software Architecture
  - Should be the first technical step

#*

Management of OO Projects in the non OO organization

The basics do not change ... just the details.

- Staffing
  - Get, keep, and train the right people. (Abstraction Skills)
- Estimating
  - Different size metrics. (MOOSE, POPS, OPA)
- Planning
  - Different milestones. (In Process Reviews)
- Tracking Progress
  - Different measures of completeness. (Use Earned Value)
- Requirements Change
  - RM very important due to incremental approach.
- Risk
  - Identify and Track (Particularly New Technology Impacts)
- **Leadership**
  - Different learning curves for staff.
  - Both new technology and new development paradigms are being introduced.
  - When the going gets tough the development staff will demand to use their tried and true methods.
  - There will be an intense desire to hack.

#*

OT Adoption Issues

- No Explicit Reason for OT
- “Hacking” Issue
  - Micro OO (without Macro OO)
- Estimation Techniques and Heuristics
  - Lack of Experience, No Industry Standards
- Software Architecture
  - How is a Product Line Approach institutionalized?
- Other Organizational Elements
  - i.e., CM, QA, Test have to change their processes
- Expectations - OT is not a Silver Bullet.

#*

Pushing OT Adoption

- Specifying "... shall use OO ..." does NOT work
  - Often get Functional Systems expressed as Objects
  - Developer gets "Time to Market" Savings when acquirer wanted High Maintainability
- Solution Strategy
  - Explicitly Determine why OO
    - (e.g., Maintainability, Reuse, Time to Market, etc.)
  - This is the requirement, not "...shall use OO ..."
  - Express the requirement in a testable way
    - Example: For a goal of high maintainability - Use Coupling, Cohesion, Inheritance Depth (and other) metrics to define design maintainability
- Remember
  - OT is not a Silver Bullet.

#*

Conclusions

- OT Adoption needs to be planned like any other project
  - Good planning implies you have a process for adoption projects
  - The adoption process needs to be tailored for OO adoptions
- DoD has a unique development culture
  - Most OO experience and practices relate to the commercial world
- OT is not a Silver Bullet
  - Be explicit about your goals and OT may be the solution
- Organizational Adoption of OO in a Federal Setting is not easy ... but it can succeed

#*

Successful Adoption and Use of Object Oriented Technologies

Jim Van Buren
Charles Stark Draper Laboratory
Software Technology Support Center
Voice: (801) 775-5555 (x3042) DSN 775-5555 (x3042)
Fax: (801) 777-8069 DSN 777-8069
Email: vanburej@software.hill.af.mil

#*